

What is claimed is:

1 1. A polarized beam splitter comprising:

2 a first prism that includes a first surface and a second surface inclined with respect to said  
3 first surface;

4 a second prism that includes a third surface that faces said second surface; and

5 an intermediate layer between said second surface and said third surface that includes an  
6 adhesive layer that bonds said first prism to said second prism and that includes a polarized light  
7 separating membrane;

8 wherein the intermediate layer is wedge-shaped with the thicker part of the wedge being  
9 located farther from said first surface than is the thinner part of the wedge so that transmission of  
10 a light beam that is incident on said first surface and which thereafter transits through the  
11 intermediate layer compensates for astigmatism of the light beam caused by the inclination of said  
12 second surface with respect to said first surface.

1 2. The polarized beam splitter of claim 1, wherein the transmission of the light beam through said  
2 intermediate layer substantially cancels astigmatism caused by the inclination of said second  
3 surface.

1 3. The polarized beam splitter of claim 1, wherein the following condition is satisfied:

2  $|N_p - N_c| > 0.2$

3 where

4  $N_p$  is the refractive index of said first prism and said second prism, and

5  $N_c$  is the refractive index of the adhesive forming said adhesive layer.

1 4. The polarized beam splitter of claim 2, wherein the following condition is satisfied:

2  $|N_p - N_c| > 0.2$

3 where

4            $N_p$  is the refractive index of said first prism and said second prism, and

5            $N_c$  is the refractive index of the adhesive forming said adhesive layer.

1       5. A projection image display device comprising:

2           a light source;

3           an illumination optical system for receiving light from said light source;

4           a time-sharing color separating system for receiving light from said illumination optical  
5 system;

6           the polarized beam splitter of claim 1 for receiving light from said time-sharing color  
7 separating system;

8           an image display element for receiving light reflected from said second surface of the  
9 polarized beam splitter and for redirecting light back toward said second surface; and

10          a projection lens for receiving light redirected by said image display element and  
11 transmitted by the wedge-shaped intermediate layer.

1       6. A projection image display device comprising:

2           a light source;

3           an illumination optical system for receiving light from said light source;

4           a time-sharing color separating system for receiving light from said illumination optical  
5 system;

6           the polarized beam splitter of claim 2 for receiving light from said time-sharing color  
7 separating system;

8           an image display element for receiving light reflected from said second surface of the  
9 polarized beam splitter and for redirecting the light back toward said second surface; and

10          a projection lens for receiving light redirected by said image display element and  
11 transmitted by the wedge-shaped intermediate layer.

1 7. A projection image display device comprising:

2 a light source;

3 an illumination optical system for receiving light from said light source;

4 a time-sharing color separating system for receiving light from said illumination optical  
5 system;

6 the polarized beam splitter of claim 3 for receiving light from said time-sharing color  
7 separating system;

8 an image display element for receiving light reflected from said second surface of the  
9 polarized beam splitter and for redirecting light back toward said second surface; and

10 a projection lens for receiving light redirected by said image display element and  
11 transmitted by the wedge-shaped intermediate layer.

1 8. A projection image display device comprising:

2 a light source;

3 an illumination optical system for receiving light from said light source;

4 a time-sharing color separating system for receiving light from said illumination optical  
5 system;

6 the polarized beam splitter of claim 4 for receiving light from said time-sharing color  
7 separating system;

8 an image display element for receiving light reflected from said second surface of the  
9 polarized beam splitter and for redirecting light back toward said second surface; and

10 a projection lens for receiving light redirected by said image display element and

11 transmitted by the wedge-shaped intermediate layer.

1 9. A projection image display device comprising:

2 a light source;

3 an illumination optical system for receiving light from said light source;

4 a Philips prism for separating light from the illumination optical system into three colors;  
5 three polarized beam splitters, each being a polarized beam splitter according to claim 1  
6 and each for receiving light of one of said three colors from said Philips prism;  
7 three image display elements, each for receiving light of one of said three colors from a  
8 second surface of a different one of said three polarized beam splitters and for redirecting the light  
9 back toward said second surface from which it receives light; and  
10 a projection lens for receiving light redirected by said three image display elements and  
11 transmitted by the wedge-shaped intermediate layers of said three polarized beam splitters.

1 10. A projection image display device comprising:

2 a light source;  
3 an illumination optical system for receiving light from said light source;  
4 a Philips prism for separating light from the illumination optical system into three colors;  
5 three polarized beam splitters, each being a polarized beam splitter according to claim 2  
6 and each for receiving light of one of said three colors from said Philips prism;  
7 three image display elements, each for receiving light of one of said three colors from the  
8 second surface of a different one of said three polarized beam splitters and for redirecting the light  
9 back toward said second surface from which it receives light; and  
10 a projection lens for receiving light redirected by said three image display elements and  
11 transmitted by the wedge-shaped intermediate layers of said three polarized beam splitters.

1 11. A projection image display device comprising:

2 a light source;  
3 an illumination optical system for receiving light from said light source;  
4 a Philips prism for separating light from the illumination optical system into three colors;  
5 three polarized beam splitters, each being a polarized beam splitter according to claim 3  
6 and each for receiving light of one of said three colors from said Philips prism;

three image display elements, each for receiving light of one of said three colors from the second surface of a different one of said three polarized beam splitters and for redirecting the light back toward said second surface from which it receives light; and

a projection lens for receiving light redirected by said three image display elements and transmitted by the wedge-shaped intermediate layers of said three polarized beam splitters.

12. A projection image display device comprising:

a light source;

an illumination optical system for receiving light from said light source;

a Philips prism for separating light from the illumination optical system into three colors;

three polarized beam splitters, each being a polarized beam splitter according to claim 4

and each receiving light of one of said three colors from said Philips prism;

three image display elements, each for receiving light of one of said three colors from the second surface of a different one of said three polarized beam splitters and for redirecting the light back toward said second surface from which it receives light; and

a projection lens for receiving light redirected by said three image display elements and transmitted by the wedge-shaped intermediate layers of said three polarized beam splitters.

13. A projection image display device comprising:

a light source;

an illumination optical system for receiving light from said light source;

a color separating and combining system that includes at least one polarized beam splitter according to claim 1 and that is for receiving light from said illumination optical system;

three image display elements, each for receiving light of one of three colors separated by said color separating and combining system and for redirecting the light back toward said second surface from which it receives the light; and

a projection lens for receiving light redirected by said image display elements and

10 transmitted by at least one wedge-shaped intermediate layer.

1 14. A projection image display device comprising:

2 a light source;

3 an illumination optical system for receiving light from said light source;

4 a color separating and combining system that includes at least one polarized beam splitter  
5 according to claim 2 and that is for receiving light from said illumination optical system;

6 three image display elements, each for receiving light of one of three colors separated by  
7 said color separating and combining system and for redirecting the light back toward said second  
8 surface from which it receives the light; and

9 a projection lens for receiving light redirected by said image display elements and  
10 transmitted by at least one wedge-shaped intermediate layer.

1 15. A projection image display device comprising:

2 a light source;

3 an illumination optical system for receiving light from said light source;

4 a color separating and combining system that includes at least one polarized beam splitter  
5 according to claim 3 and that is for receiving light from said illumination optical system;

6 three image display elements, each for receiving light of one of three colors separated by  
7 said color separating and combining system and for redirecting the light back toward said second  
8 surface from which it receives the light; and

9 a projection lens for receiving light redirected by said image display elements and  
10 transmitted by at least one wedge-shaped intermediate layer.

1 16. A projection image display device comprising:

2 a light source;

3 an illumination optical system for receiving light from said light source;

a color separating and combining system that includes at least one polarized beam splitter according to claim 4 and that is for receiving light from said illumination optical system;  
three image display elements, each for receiving light of one of three colors separated by said color separating and combining system and for redirecting the light back toward said second surface from which it receives the light; and  
a projection lens for receiving light redirected by said image display elements and transmitted by at least one wedge-shaped intermediate layer.

17. A polarized beam splitter comprising:

a first prism that includes a first surface and a second surface inclined with respect to said first surface;

a second prism that includes a third surface that faces said second surface;

an intermediate layer between said second surface and said third surface that includes an adhesive layer that bonds said first prism to said second prism and a polarized light separating membrane; and

wherein the following conditions are satisfied:

$$N_c \geq 1.75$$

$$N_p \geq 1.85$$

$$|N_p - N_c| < 0.2$$

where

$N_p$  is the refractive index of said first prism and said second prism, and

$N_c$  is the refractive index of the adhesive forming said adhesive layer.

---

18. The polarized beam splitter of claim 17, wherein the intermediate layer is wedge-shaped and the thicker part of the wedge is located farther from said first surface than is the thinner part of the wedge so that transmission of a light beam that is incident on said first surface and thereafter transits through the intermediate layer compensates for astigmatism of a light beam caused by the

5 inclination of said second surface with respect to said first surface.

1 19. The polarized beam splitter of claim 18, wherein the transmission of the light beam through  
2 said intermediate layer substantially cancels astigmatism caused by the inclination of said second  
3 surface.

1 20. A projection image display device including the polarized beam splitter of claim 1.